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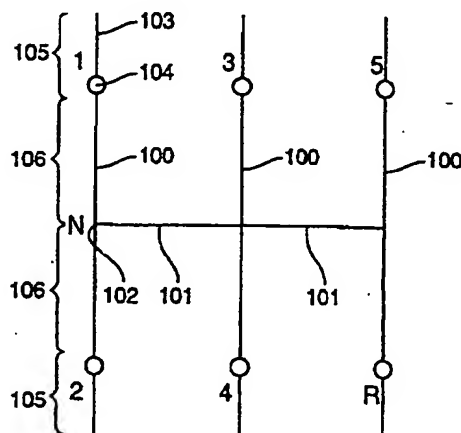
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(54) Abstract Title

Gear shift gate with regions which indicate an intention to shift gear

(57) A motor vehicle comprises an automatic clutch (3, fig 1) and a transmission (4) having transmission ratios which are selected gear lever (13) which moves in a gear shifting gate 101. A sensor arrangement (14) detects actuation of the gear lever and transmits signals to a control unit (12) which operates the automatic clutch. The gear shifting gate 101 is divided into regions 105, 106 etc in which different threshold values are used for indicating an intention to shift gear. For example in region 105 there can exist a changes or altered evaluation of signals, as compared with an evaluation in regions 104 and/or 106, so that if an overstressing condition occurs an intention to shift may be interpreted as being undesirable. It is possible to raise and/or reduce the threshold values in the region 105. Other embodiments relate to continued operation of the clutch and transmission after a defect in, for example, a gas pedal system has occurred.

Fig. 2



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Motor Vehicle with Control Unit that Produces a Clutch
Actuation Signal

The invention relates to a motor vehicle with a driving
5 unit, such as for example a motor or a combustion engine,
a transmission and an automated torque transmitting system
such as for example a clutch, a friction clutch or a
magnetic powder clutch, the transmission ratio being
selectable by an actuating element such as for example a
10 shifting lever, a sensor arrangement detecting the
actuation of the actuating element and a control unit
being adapted to generate a control signal in response to
which the torque transmitting system is disengaged in the
event of an actuation of the actuating element.

15

It is known from DE 17 55 528 that, in such motor vehicles
with automated torque transmitting systems, a shifting
operation by actuation of the actuating element is
possible only when the throttle valve is not actuated.

20

In technical systems, such as in the aforesaid motor
vehicles, even minor irregularities or defects can grow to
proportions which are critical from the standpoint of
operability or safety and which cannot be accepted for
25 reasons or operability or safety.

In a motor vehicle which embodies an automated torque
transmitting system which permits a shifting of the
transmission only when the gas pedal is not actuated,
30 i.e., in the event of actuation of an idling switch which
detects whether or not the gas pedal assumes its idle
position, a situation which is critical from the
operational or safety standpoint can arise, for example,
in the event of the development of a defect in the region
35 of connection between the gas pedal and the engine, for
example in that the gas pedal jams and such defect does

not permit a resetting of the gas pedal and actuation of the idling switch even when the gas pedal is not actuated. Under such circumstances, the automated torque transmitting system assumes, based on the then available
5 sensor values, that the gas pedal is being actuated on purpose, for example by the driver, and a shifting of the transmission or transmission gears is difficult to accomplish due to the absence of disengagement of the torque transmitting system.

10

In a motor vehicle with an automated torque transmitting system, it is necessary that an actuation of the actuating element, such as for example a gear shifting lever, can lead to a disengagement of the torque transmitting system
15 when it appears likely, on the basis of sensor signals that were evaluated by the control unit, that such actuation is indeed desired by the driver. However, a disengagement of the torque transmitting system should not take place in each and every case to thus ensure that an
20 unintended interruption of acceleration of the vehicle will not occur when a shifting operation is not desired, for example, at high rotational speeds of the engine and merely as a consequence of the placing of a hand onto the actuating element. In accordance with DE 17 55 528, this
25 is accomplished in that a disengagement of the torque transmitting system takes place only at a minimal position of the throttle valve.

According to a first aspect of the invention, there is
30 provided a motor vehicle with a driving unit, a transmission and an automated torque transmitting system, the transmission ratio being selectable by means of an actuating element and a sensor arrangement detecting the actuation of the actuating element within a gear shifting
35 gate of a transmission, characterised in that the gear shifting gate is divided into at least two regions in

which different limit values are utilised for detection of a shifting intention.

5 It can also be of advantage if the limit values which are utilised for a determination of an intention to shift be varied for example as a function of time.

10 Furthermore, such limit values or threshold values can also be varied as a function of other operational parameters, for example, as a function of the engine RPM.

15 It can be of advantage if, on reaching or exceeding of the limit values, such limit values be altered, such as raised or lowered, by the actual data. Furthermore the changes can be altered, again, in dependency on time.

20 The vehicle preferably has a control unit which is adapted to generate a control signal in response to which the torque transmitting system is disengaged upon actuation of the actuating element, characterised in that the control signal is generated when a brake is actuated simultaneously with the actuating element.

25 A control signal may also be generated when, in addition, there is actuated a load lever, such as a gas pedal.

30 It can be of advantage if the brake is a vehicle brake or a parking brake, such as for example a manually operated brake.

35 Furthermore, it can be desirable that, among other situations, the control signal be generated also when a load lever and a vehicle brake and a parking brake are actuated simultaneously while the actuating element is being actuated.

Furthermore, a control signal can be generated when the actuating element is actuated while the speed of the vehicle is less than a preselectable limit value.

- 5 It is of advantage if the preselectable limit value is within a range of 0 to 50 km/h, preferably of 0 to 30 km/h, and especially of 0 to 10 km/h.

Furthermore, it can be of advantage if, in a motor vehicle
10 with a driving unit and a transmission and an automated torque transmitting system, the transmission ratio being selectable by means of an actuating element such as for example a gear shifting lever, a sensor arrangement detecting the actuation of the actuating element and a
15 control unit being adapted to generate a control signal in response to which the torque transmitting system is disengaged in the event of actuation of the actuating element, the control signal be generated and the torque transmitting system be disengaged in the event of
20 actuation of the actuating element and in response to fulfilment of at least one of the following prerequisites:

- an idling switch is actuated,
- displacement of a load lever controlling the driving
25 unit is smaller than a preselectable limit value,
- a throttle valve angle of the vehicle driving unit is smaller than a preselectable limit value.
- a vehicle brake is actuated,
- a vehicle parking brake is actuated,
- 30 - a sensor indicates that a vehicle door is open,
- the speed of the motor vehicle is less than a preselectable limit value,
- the torque of the driving unit is smaller than a preselectable limit value,
- 35 - the RPM of the driving unit is smaller than a preselectable limit value,

- the value of the gradient of the driving unit torque in the event of a negative gradient exceeds a preselectable limit value,
- the value of the gradient of the driving unit RPM in the event of a negative gradient exceeds a preselectable limit value,
- the value of the gradient of the vehicle speed in the event of a negative gradient exceeds a preselectable limit value.

10

The individual prerequisites can be linked by AND or OR-connections.

For example, the disengagement of the torque transmitting system takes place also when the engine torque which has been ascertained by the control unit is above a preselected limit value but the nature of the other signals is such that they can be interpreted as denoting a desire by the driver to shift the transmission into a different gear.

Furthermore, it might be desirable that an intention to shift be found to be permissible if

- the engine torque exceeds a preselectable limit value,
- the engine RPM exceeds a preselectable limit value,
- the value of the gradient of the engine torque at a positive gradient is less than a preselectable limit value,
- the value of the gradient of the engine RPM at a positive gradient is less than a preselectable limit value and/or
- the value of the gradient of the vehicle speed at a positive gradient is less than a preselectable limit value,

and if such prerequisites are satisfied alone or in combination with other prerequisites in order to reach the conclusion that an intention to shift actually exists.

5 Furthermore, it can be of advantage if, in a motor vehicle with a driving unit, a transmission and an automated torque transmitting system, the transmission ratio being selectable by means of an actuating element such as for example a gear shifting lever, a sensor arrangement
10 detecting the actuation of the actuating element and a control unit being adapted to generate a control signal in response to which the torque transmitting system is disengaged in the event of actuation of the actuating element, the control signal be generated and the torque
15 transmitting system be disengaged in response to actuation of the actuating element and after elapse of a waiting time Δt , provided that the actuating element continues to be actuated after the elapse of such waiting time and in response to fulfilment of a least one of the following
20 prerequisites:

- the idling switch is actuated,
- the load lever is smaller than a preselectable limit value,
- 25 - the throttle valve angle is smaller than a preselectable limit value,
- the vehicle brake is actuated,
- the parking brake is actuated,
- a sensor indicates that a vehicle door is open,
- 30 - the vehicle speed is less than a preselectable limit value,
- the engine torque is smaller than a preselectable limit value,
- the engine RPM is smaller than a preselectable limit
35 value,

- the value of the gradient of the engine torque in the event of a negative gradient exceeds a preselectable limit value,
- the value of the gradient of the engine RPM in the event of a negative gradient exceeds a preselectable limit value,
- the value of the gradient of the engine speed in the event of a negative gradient exceeds a preselectable limit value.

10

The aforementioned waiting time can be within the time range of 0.1 second to 10 seconds, preferably within the time range of 0.5 second to 5 seconds.

15 The invention will be explained in greater detail with reference to the Figures. There are shown in:

Figure 1 a schematic representation of a vehicle,

20 Figure 2 a representation of a gear shifting gate,

Figure 2a a detail of a gear shifting gate, and

Figure 3 a diagram.

25

Figure 1 shows a vehicle 1 in a schematic representation with a driving unit 2, a torque transmitting system 3 and a transmission 4. The transmission is followed by a drive shaft 5 and a differential 6 as well as the driven axles 7a and 7b, the wheels 8a and 8b being driven by way of the driven axles 7a and 7b. The vehicle can also be equipped with a four-wheel drive. However, this is not shown in Figure 1.

35 The torque transmitting system 3, such as for example a friction clutch, a magnetic powder clutch or a torque

converter with torque bypass clutch, is shown in Figure 1 as a torque transmitting system 3 in the power train between the motor 2 and the transmission 4; however, it is also possible to install the torque transmitting system 3 at the downstream side past the transmission 4 in a manner which can be of advantage, for example, with infinitely variable split transmissions (CVT).

In the embodiment which is shown in Figure 1, the torque transmitting system 3 comprises a clutch disc 3b with friction linings, a pressure plate 3c as well as a clutch cover 3d and a diaphragm spring 3e. These parts of the torque transmitting system can be mounted on a flywheel 3a, and they can also be assembled with the flywheel 3a as a preassemblable unit. Also, the flywheel can constitute a so-called twin-mass flywheel which comprises a torsional damper between a primary and a secondary mass. The diaphragm spring 3e is acted upon by the disengaging bearing 3f to engage or disengage the clutch. By causing the disengaging bearing 3f to act upon the tongues of the diaphragm spring, the clutch can be induced to assume a condition or can be adjusted in such a way that it assumes a condition which is a fully engaged or a fully disengaged condition or a condition between such extreme conditions. In this manner, the torque which can be transmitted by the torque transmitting system can be selected or fixed at will within the range between zero and the maximum value.

In the embodiment of Figure 1, the disengaging bearing is actuated by a disengaging lever 9, and this disengaging lever is actuated by a hydraulic system with a slave cylinder 10, a hydraulic conduit 11 and an actor 12. The actor 12 contains an adjusting device 12a which, if a hydraulic system is employed, comprises a master cylinder and a driving unit for actuation of the master cylinder. The actor 12 further comprises an electronic arrangement

12b, such as a control unit, which processes signals being transmitted for example by sensor arrangements, sensors or other electronic units and generates control signals in order to operate the driving unit of the actor for the purpose of engaging or disengaging the torque transmitting system.

The transmission 4 is a transmission in which one can distinguish between various transmission ratios, such as gears, by means of an actuating element 13. In order to select a transmission ratio among a plurality of transmission ratios, the actuating element 13 is moved to the corresponding position or is actuated in a manner and wise provided therefor. Such actuation can be effected manually or automatically.

As already mentioned above, the arrangement for disengaging the torque transmitting system can be operated by a pressurised-fluid system, and such pressurised-fluid system can constitute a hydraulic system, a pneumatic system or another fluid-operated system. In such instances, the disengaging element can also constitute a central disengaging element which is operated by a pressurised fluid. Further, the actuation can be effected by mechanical means, such as for example a linkage.

A sensor arrangement 14 can be coupled to or provided on the actuating element 13, and this sensor arrangement detects an actuation of the actuating element. The detection of an actuation can take place by measuring an acting force or by measuring a change of position or of a change of speed or acceleration. Furthermore, the actuation can be detected in the event of exceeding a limit or threshold value during a movement or actuation of the actuating element.

The sensor or the sensor arrangement 14 can be a travel- or velocity- or acceleration- or force-dependent sensor which detects or which can detect a movement of the actuating element or of an element which is connected therewith or a force acting upon the actuating element or upon an element which is connected therewith.

Furthermore, it is possible to provide on the transmission a sensor 15 which detects the position of the shifted-in gear, for example, by sensing the position of shifting elements in the interior of the transmission.

The sensors, such as the throttle valve sensor 16, the wheel RPM or velocity sensor 17 (vehicle speed sensor), engine RPM sensor 18 and further sensors can be provided in/at the vehicle and connected with the control unit by signal transmitting conductors. It is also possible to provide on the vehicle a door sensor which detects whether a door is open. It is also advisable to provide a sensor for detection of the throttle valve angle. The control unit can also serve to calculate, from the data furnished by sensors, gradients which are utilised to evaluate the intention to shift. For example, such gradients can be calculated by resorting to numerical procedures. Based on the sensor data and other data as well as system input values, the control unit 12 ascertains the condition of the vehicle and generates a control signal for actuation of the torque transmitting system 3 in the event of conclusion that an intent to shift does exist.

If the driver actuates the actuating element of the transmission, the control unit disengages the torque transmitting system by generating a signal to disengage the torque transmitting system. However, as a rule this happens only when the calculated or ascertained engine torque is smaller than or equals a preselectable value of

torque. Furthermore, an intention to shift can be rated as suppressed or as not established when, in addition to the determined engine torque, the position of the throttle valve or the position of the load lever also exceeds a
5 limit value.

The motor vehicle 1 further comprises a gas pedal 20, such as a load lever, as well as an actuating element of a brake 21, such as a vehicle brake, as well as an actuating
10 element 22 for a brake, such as a parking brake. At the load lever 20, there is disposed at least one sensor 23 which ascertains not only the extent of displacement a but also the presence or absence of an actuation. A sensor which can determine whether the pedal or the load lever is
15 or is not actuated can constitute an idling switch which is on when the pedal is not actuated and which is off when the pedal is actuated.

At the actuating element 21 for the vehicle brake, such as
20 a brake pedal, there can be provided a brake switch 24 which detects whether the brake is actuated. Such a brake switch can also be provided at the actuating element 22 for the parking brake, and the sensor 25 detects whether the parking brake is actuated.

25 Furthermore, the sensor arrangement 23 for the load lever 20 can be in signal transmitting connection with the engine electronics 30 so that, in response to actuation of the gas pedal, the engine electronics 30 regulate the
30 engine RPM and the engine torque accordingly.

Based on the signals, such as measurement data and system input values, which are being transmitted to the control unit 12, it is possible to ascertain the then transmitted
35 engine torque.

The transmitted engine torque is the actual engine torque minus/plus the torques which are taken up or transmitted by the auxiliary aggregates. For example, an air conditioning system or an inertia flywheel can be termed
5 an auxiliary aggregate. Furthermore, it is possible to take into consideration drag torques.

Furthermore, it is possible to ascertain whether the actuating element 13 is being actuated, whether a brake
10 21, 22 is being actuated and whether the gas pedal, such as load lever, is being actuated. The control unit 12 recognises an intention to shift on the basis of actuation of the actuating element 13 in response to signals which are being transmitted by the sensor 14 and/or 15. Whether
15 an intent to shift is evaluated or accepted by the control unit as a desire to shift and results in the generation of a control signal to disengage the clutch depends upon the system parameters.

20 For example, it is not invariably desirable that a shifting intention denoting signal be invariably interpreted as denoting an imminent gear shifting operation. As a rule, it is assumed - as a prerequisite for a desired gear change or for shifting out of a
25 particular gear - that the engine torque be below a preselectable limit value and/or that the extent of actuation of the load lever be less than a preselectable limit value. This means, for example, that the load lever is not actuated and that this is being indicated by the
30 idling switch. However, such a prerequisite does not suffice under certain circumstances which are critical for proper operation or adequate safety.

Furthermore, such prerequisites can be interlinked in such
35 a way that not only is the engine torque below a preselectable limit value but the extent of actuation of

the load lever is also below a preselectable limit value. Furthermore, it can be of advantage that, under certain driving conditions, while exceeding at least one of the aforementioned limit values an intention to shift is
5 interpreted as existing nevertheless and the control unit generates a control signal so that the torque transmitting system is disengaged. For example, such control signal can be generated if, for example, an actuation of the actuating element for the purpose of gear shifting takes
10 place simultaneously with the actuation of the load lever and e.g., one of the brakes. Furthermore, it can be of advantage if, at a vehicle speed which is less than a comparable reference speed, the control signal to disengage the torque transmitting system is generated
15 during actuation of the actuating element.

Such acceptance of an intention to shift and the generation of a control signal at low vehicle speeds might be desirable in the event of a disturbance, for example,
20 of the gas pedal, e.g., as a result of jamming or another faulty operation, in order to shift from a particular gear. This is particularly desirable while the vehicle is being driven at low speeds, such as for example within the velocity range of between 0 and 50 km/h, preferably of 0-30
25 km/h or of 0-10/20 km/h.

A further regulating method which can be of advantage in the event of the aforementioned operating conditions or faulty operations of the gas pedal system or in the
30 vehicle can be that simultaneous actuation of a brake and of the gas pedal allows for acceptance of an intention to shift whereupon the control unit generates a control signal in order to disengage the torque transmitting system.

35

In addition to the brake or brakes, it is also possible to employ additional signals which, for example, must be present simultaneously with that from the gas pedal in order to accept an intention to shift in response to an
5 actuation of the actuating element and to generate a control signal which disengages the torque transmitting system.

If the gas pedal system is operative, it is advisable that
10 the control unit ascertain an intention to shift on the basis of incoming signals, and such intention is examined prior to generation of a control signal for the purpose of disengaging the torque transmitting system. When the brake is not applied or when the vehicle speed is high, it might
15 be advisable that the control unit evaluate a shifting intention signal as non-existent in spite of actuation of the actuating element when the engine torque exceeds a certain limit value. This should prevent faulty disengagements because one can assume that the driver
20 would be unlikely to shift when the engine torque is high. However, if a reduction of the engine torque has taken place, one can assume that the driver would like to shift and, under such circumstances, it is desirable that the intention to shift be interpreted as such and entails the
25 generation of a control signal in order to disengage the torque transmitting system.

However, even following a cold start, the engine might be capable of furnishing - for example as a result of
30 ignition shift or cold start enrichment or in accordance with other methods - during idling a torque which is above the limit torque and prevents that an intention to shift be evaluated as such and that it entail the generation of a control signal for disengagement of the clutch.
35 Therefore, it might be advisable as a rule or under such operating conditions to also monitor the idling switch in

addition to a comparison of the actual engine torque with a limit value. If the idling switch is actuated, i.e., if the throttle valve value is below a limit value, the intention to shift is interpreted as such and there is
5 generated a control signal which entails a disengagement of the torque transmitting system. Thus, an intention to shift is always possible during idling, namely when the idling switch is actuated, and a shifting operation is rendered possible in that the torque transmitting system
10 is disengaged in response to actuation of the actuating element.

If, based on the input signals such as sensor values and other signals, the control unit 12 detects an intention to
15 shift, such intention is first tested prior to disengagement of the clutch. Under customary circumstances of operation of the vehicle, it is advisable that the intention to shift be disregarded by the control unit when the engine torque exceeds a predetermined limit value.
20 Such predetermined torque, minus for example the drag torques and torques attributable to auxiliary consumers, is compared by the control unit with a reference value and, when the engine torque exceeds the limit value, an intention to shift is interpreted as non-acceptable and
25 the torque transmitting system is not disengaged. This should prevent faulty disengagement because one can assume that the driver would not wish to shift while he demands a torque (output). However, it is also conceivable to resort to other mechanisms which prevent an intention to shift
30 under certain circumstances, for example, a time delay during forwarding of the intention to shift. This means that, in spite of a high engine torque, an intention to shift which is indicated upon actuation of the actuating element will be accepted after elapse of a waiting time At
35 provided that an actuation of the actuating element is still present after elapse of the waiting time. Under such

circumstances, the torque transmitting system is disengaged in spite of the existence of a high engine torque.

- 5 The aforementioned waiting times can be within the time span of 0.1 second to 10 seconds, preferably within a time span of 0.5 second to 5 seconds.

10 Following a cold start, the engine in its capacity as the driving unit of the vehicle can furnish during idling an engine torque which is above the preselectable limit value, for example, as a result of an ignition shift and/or cold start enrichment or by resorting to other methods. This can entail, under certain circumstances, a
15 rolling of the vehicle and, due to a cancellation of the intention to shift, it is not possible or quite difficult to shift the transmission out of gear. Such situation can become critical from the standpoint of safety if the shifting intention is interpreted as not recognised and
20 the torque transmitting system remains engaged. Furthermore, it can become critical if the gas pedal becomes stuck, for example, due to a defect while the engine is not idling and, therefore, the intention to shift cannot be followed. It can also become critical,
25 from the standpoint of safety, if the intention to shift is disregarded for other reasons.

An intention to shift can be always accepted as being in existence when the idling switch is actuated, namely when
30 the gas pedal has reassumed its idling position of rest. Furthermore, it might be advisable that, in addition to those furnished by the idling switch, other signals and/or combinations of the signals be utilised in order to accept the shifting intention, i.e., to disengage the torque
35 transmitting system in response to an actuation of the actuating element. It can be particularly desirable if the

idling switch is actuated and/or the gas pedal value, namely the load pedal value is below a limit value. Analogously, it is possible to take into consideration also the signal denoting the angle of the throttle valve
5 or other signals denoting that the driver demands an output, and such signals, too, should be below preselectable threshold values. Furthermore, it can be desirable to recognise or interpret a shifting intention as valid when the vehicle brake is operated or when the
10 parking brake is actuated. Furthermore, it is possible to address a door contact switch and to accept an intention to shift when a door is open and this is being indicated by the signal from the door contact switch. It is also possible to employ other signals which indicate that the
15 driver does not desire to set the vehicle in motion. For example, this can happen when a driver in the vehicle is not recognised, such as for example by a seat sensor so that the shifting out of gear must be carried out by a driver's mate which, in such case, should be prevented by
20 the control unit if at all possible.

It can also be desirable if an intention to shift is invariably accepted at lower driving speeds, such as for example within the range of from 0 to 10 km/h or 0 to 20
25 km/h or 0 to 50 km/h.

It can also be desirable if an intention to shift is accepted on actuation of the actuating element for the purpose of changing the transmission ratio and the torque
30 transmitting system is disengaged when the engine RPM is below a preselectable limit value, such as about 1400 RPM or 2000 RPM.

Still further, it can be of advantage if the value of the
35 gradient of RPM and/or speed of the vehicle is above a

preselectable value; in such case, the gradient should be a negative gradient.

For example, such a situation can arise when the driver
5 would like to stop but is incapable of shifting out of gear.

It is further proposed that, in such cases and/or all other combinations of characteristics, the shifting
10 intention recognition be set to be more sensitive. For example, the shifting intention thresholds can be set to be below those under other, namely typical, driving conditions. Such more sensitive setting of the recognition of the intention to shift denotes that the threshold
15 values which are set as preselectable threshold values are shifted nearer to the position of a non-actuated system or nearer to the values of the non-actuated actuating element in order to detect, on the basis of values of signals furnished by the sensors, whether or not the actuating
20 element has been actuated.

A change of the thresholds of intention to shift or of preselectable limit values which lead to the intention to shift can also be regulated in dependency on time which
25 means that an intention to shift takes place after a certain time delay. Different shifts in time can be defined for different driving conditions.

Furthermore, it can be of advantage if the limit values
30 are preselectable under customary driving conditions. Under those circumstances of the operation of a vehicle when safety-related situations might become relevant with a higher degree of probability, it is possible to carry out a staggered utilisation of limit values. For example,
35 if an actuation of the actuating element takes place in a situation when the engine torque is higher, the intention

to shift can be suppressed upon exceeding of a first threshold value because it is assumed that a desire to shift does not exist. However, if the actuation continues and the actuating element is guided beyond a second
5 threshold value, one can assume that an intention to shift does exist and the transmission of torque can be interrupted because one can assume that the driver of the vehicle knowingly actuates the servicing lever. Therefore, it is proposed to define for the threshold values a second
10 set of disengaging thresholds and to introduce such values for the recognition of an intention to shift. If the actuation of the actuating element exceeds such second threshold as a result of actuation of the actuating element by the driver, an intention to shift can be
15 presumed independently of other signals and the torque transmitting system can be disengaged in response to the generation of a control signal.

As already explained hereinbefore, a detection of an
20 intention to shift is carried out by at least one sensor which monitors the movement of an actuating element and/or the position of an actuating element and/or the speed and/or the acceleration of an actuating element. Furthermore, such a sensor can also detect the application
25 of forces to the actuating element, either directly or indirectly. By utilising a distance sensor in the region of the actuating element and a movement sensor in the region of shifting elements in the interior of the transmission, and if one assumes the presence of elastic
30 parts in the power flow between the actuating element and the internal shifting elements of the transmission, it is possible to carry out a measurement of differences between various distances in order to obtain a signal which is proportional to or representative of the forces and can be
35 utilised for an evaluation of the intention to shift.

It is further possible to carry out, among others, a velocity-dependent recognition of an intention to shift when the vehicle employs an automated clutch system. If the velocity of the shifting lever (such velocity can be
5 filtered or otherwise modified) exceeds a preselectable limit value, an intention to shift may exist and can be initiated by the control unit. The speed of the shifting lever can be evaluated in different ways in dependency upon the direction, for example in a direction toward the
10 position in neutral gear or in the opposite direction. If the transmission is shifted into a gear by hand, the driver normally forces the gear shifting lever in a direction toward and beyond the selected gear in order to ensure that the transmission is being shifted into the
15 desired gear. As used herein, the term forcing or overshifting is intended to denote that the shifting lever, such as the aforementioned actuating element, is caused by the driver to move in a direction toward the selected gear beyond that position and/or with a force
20 greater than necessary for actual shifting into such gear. Such overshifting entails an elastic prestressing of some or even all of the elements which participate in a gear shifting operation. When the driver thereupon releases the lever, the latter can relatively rapidly return to the
25 actual (non-exceeded) position of rest in the selected gear. Such return movement or relaxation to the actual position in a selected gear can take place at a speed which exceeds the preselectable limit speed for recognition of an intent to shift. Such exceeding by the
30 actual velocity of the preselectable limit value can be detected and unintentionally interpreted as an intention to shift so that it actually triggers a shifting operation with short-lasting disengagement of the clutch. When the step of relaxation of the shifting lever is completed, the
35 shifting lever is again at a standstill essentially in a position corresponding to the idle condition of the gear

shifting means and the intention to shift no longer exists.

Such short-lasting disengagement subsequent to release of
5 the shifting lever from its overshifted position furnishes
an undesirable uncomfortable effect. The rebounding or
relaxing of the shifting lever basically takes place
within a range which, in a direction toward neutral, is
limited by the position of rest of the shifting lever when
10 the transmission is in gear. As long as the shifting lever
dwells within such range, which might possibly be widened
by a tolerance band, the intention to shift can be
additionally scanned or rendered more difficult or
prevented in one or more following ways.

15

This range is a range of positions of the shifting lever
starting from the position of rest in gear and in a
direction away from the neutral position.

20 Figure 2 illustrates this situation in connection with a
typical gear shifting gate for movements of a gear
shifting lever in a change speed gear. The actuating
element or shifting lever is moved along the several
shifting paths 100 to shift into and from gears, for
25 example, from the neutral position along the selecting
paths 101 to change its position between the shifting
paths 100. For example, in order to move the shifting
lever from a neutral region into the first gear, the
shifting lever is guided, for example, from the point 102
30 to the point 103 because the driver does not know exactly
the position of rest in the first gear 104 and, as a rule,
does not immediately advance the shifting lever exactly to
the optimum position for the first gear. When the shifting
lever is released, it relaxes or eases into the gear rest
35 position 104, i.e., the shifting lever moves from the
point 103 to the point 104. In the course of such

movement, the shifting lever can attain a speed which can exceed the preselectable limit value that is required to initiate a shifting intention. Therefore, and as concerns the threshold values as well as the initiation of a
5 shifting intention, the region 105 is interpreted differently from the region 106 which latter extends from the rest position 104 for the particular gear in a direction toward neutral. On the other hand, the region 105 is directed from the gear rest position 104 and away
10 from neutral.

In the selected region 105 which, in the region of the gear rest position, can overlap for example with the region 106 in a manner as shown in Figure 2a, there can
15 exist a changed or altered evaluation of signals for recognition of the intention to shift, as compared with an evaluation in the region 104 and/or 106. In the region 105 of overstressing, an intention to shift can invariably be interpreted as being undesirable.

20 Furthermore, it is possible to raise the preselectable limit values or release threshold in the region of overstressing, i.e., an initiation of the intention to shift in the region of overstressing must satisfy
25 increased requirements as concerns the changes pertaining to the servicing lever or shifting lever. Furthermore, it is possible to filter the movement or velocity signals from the sensors, especially to resort to a more pronounced filtering action than in the normal region. In
30 this context, this is intended to express that the filtering operation is carried out with an increased time constant which entails a time-dependent smoothing or also a delay of the effects. Still further, it is desirable to resort to the above enumerated methods only for a limited
35 period of time and, once such period has expired, a recognition of the intention to shift is carried out in

accordance with methods which can also be resorted to in the region 106. As the start of the interval of time At subsequent to which the recognition of an intention to shift is again carried out in accordance with normal
5 methods, one can take into consideration the instant of recognition of a new gear which has been shifted into or the instant of reaching the position of rest in the newly shifted into gear or the instant of the start of overstressing or exceeding of the position of rest in the
10 particular gear or of the exceeding of an overstressing limit.

Furthermore, it can be of advantage if an intention to shift is considered as non-existent, so that a disengagement of the torque transmitting system is
15 prevented, only while the signal or signals from sensor or sensors indicates or indicate an overstressing. For example, an overstressing can be detected by measuring the magnitude of the force or by measuring the extent of stretching of the external circuitry, namely the
20 connection between the shifting lever and the transmission. Still further, it is possible to resort to a combination of the aforementioned conditions.

The region of overstressing and the location of the
25 shifting lever in such a region of overstressing can be monitored by the existing sensors, or one employs additional sensors which can be designed, for example, as digital or continuous, analog sensors and monitor the position of the shifting lever in the region of
30 overstressing.

As described hereinbefore, the detection of an intention to shift on the basis of a movement of an actuating element necessitates the division of the actuating
35 movement of the actuating element into at least two regions. Starting from the neutral position, one of the

regions is selected to extend essentially to the position of rest in the selected gear and the second region extends, starting essentially from the position of rest, in a direction away from the neutral position. One can resort to different evaluations of sensor signals, of the movement, position, speed, acceleration or force of the actuating element or upon the actuating element, depending upon whether the actuating element is located in the one or the other region. It is preferred to carry out an increase of the preselectable limit values in that one region which is the region of overstressing in order to avoid a shifting intention as a result of a relaxation of the shifting lever upon completion of a gear shifting operation.

When the clutch is an automated clutch, the basic purpose of detection of the intention to shift is to ascertain the desire of the driver as far as shifting is concerned. If a desire to shift is detected on the basis of sensor signals which are being transmitted to the control unit and an appropriate evaluation of such signals, the clutch is normally disengaged in order to ensure that shifting out of a gear is made possible in response to the exertion of a relatively small force by the driver of the vehicle. In many instances, the intention to shift is detected in such a way that one or more sensor signals, which might have already undergone a preliminary treatment, such as filtering, exceed a fixed or a variable preselectable threshold. This can readily entail a back and forth shifting of the intention to shift if the sensor signal alternately exceeds and falls below the preselectable threshold, i.e., if the intensity of the signal fluctuates. For example, such a situation can arise if the intention to shift is recognised on the basis of fixed distance thresholds and the position of the manually shiftable lever exceeds such thresholds. If the driver

maintains the shifting lever on the border of distance thresholds, for example, by placing his hand in the region of the shifting lever, or shifts very slowly, even slight vehicle- or driver movements, such as oscillations, can
5 entail repeated exceeding and falling below the threshold values. Even a disengagement of the clutch can entail an acceleration of the vehicle which can influence the shifting lever through the driver or through the vehicle. In the event that the intention to shift is detected as a
10 result of force measurement at the shifting lever, or at another location between the transmission and the shifting lever, it is also possible that there develops a back and forth oscillation or an exceeding or falling below the threshold values. An intention to shift is initiated when
15 the actuating force exceeds a certain limit value. This, too, can result in oscillations, i.e., in exceeding of or in falling below the threshold value as a consequence of intentional or unintentional retention at the release threshold. Such effect is enhanced in that the clutch
20 becomes disengaged in the event of an intention to shift. This causes the transmission to furnish no output or a lesser output and the shifting force can be reduced. This entails a decrease of the actuating force and the release threshold is not reached. A similar effect can develop
25 also in the event of a measurement of differences between distances which involves distance measurements at two locations in the region between the shifting lever and the shifting elements for the transmission, it being assumed that elastic parts are disposed between the two locations.
30 Under such circumstances, it might be of advantage if the preselectable limit values, which must be exceeded in order to initiate an intention to shift are provided with a hysteresis which means that, if the preselectable limit value is exceeded, the limit value is reduced by an amount
35 ΔG_{renz} . In other words, the signal must exceed the threshold. As soon as the signal has exceeded the

threshold of the intention to shift, or has exceeded the limit value, the threshold is caused to be lowered by a certain amount. The intention to shift is withdrawn and the threshold or the limit value is increased again only
5 when the signal again drops below the lowered threshold or the lowered limit value. The amount ΔGrenz of lowering can be variable or a function of time. The value ΔGrenz can be selected in different ways and can even rise or fall thereafter as a function of time in dependency on the
10 operating point, such as for example the selected gear, the engine RPM or the position of the throttle valve. Alternatively, it is also possible to manipulate, namely increase, the signal value. The extent of lowering and subsequent increase can even begin as a function of time
15 and can also be withdrawn as a function of time. Such situation is illustrated in Figure 3 wherein a signal, for example that from a sensor, for detection of an intention to shift is represented as a function of time. For example, the signal can denote the position of the
20 actuating element, such as a shifting lever, and is detected as a function of time.

From the instant t_0 to the instant t_1 , the signal 200 is below the preselectable limit value for the initiation of
25 an intention to shift. At the instant t_1 , the signal 200 exceeds the threshold of the intention to shift at which time the threshold of the intention to shift is immediately lowered from the value 201 to the value 202. The signal 200 varies during the interval between t_1 and t_2
30 but it reaches the threshold 202 only at the instant t_2 so that, from the instant t_2 , the intention to shift is interpreted as having been withdrawn. Simultaneously, namely at the instant t_2 , the threshold of the intention to shift or the preselectable limit value for the initiation
35 of an intention to shift is reset to the value 201. It is

also possible to provide a time-dependent threshold 203 as an alternative of the fixed threshold 202.

If an intention-to-shift signal is present, i.e., the
5 actuating element is being actuated and, for example, the
engine torque is below a preselectable threshold value,
the control unit generates a control signal so that the
torque transmitting system is disengaged. The
10 disengagement of the torque transmitting system can take
place as expeditiously as possible or at a variable speed
in dependency upon the shifting operation. For example,
based on the incoming signals the control unit can
ascertain and recognise the driving condition of the
15 vehicle and, based on the information pertaining to the
operating condition, the clutch can be engaged at a lower
or at a higher speed when an intention to shift does
exist. This can be of advantage in order to weaken or
avoid impacts on disengagement of the clutch. If, upon
20 recognition of an intention to shift, the shifting
velocity (namely the speed of movement of the actuating
element) is below a preselectable threshold and at the
same time, for example, the engine torque is below a
preselectable threshold and/or the speed of the vehicle is
below a preselectable threshold, the clutch is disengaged
25 at a slower rate but at a predetermined speed, for
example, at 30 Nm per second.

As a rule, a normal shifting operation takes up an
interval in the range of between 0.1 second and 0.5
30 second. Thus, a slow shifting operation can stretch out
for an interval of for example 0.4 second to 2 seconds or
even longer. The lower limit for such a slow shifting
operation from one shifted-into gear to another shifted
into gear can depend, however, upon the vehicle and the
35 transmission which is being utilised in the vehicle. The
shifting operation can be identified as a slow shifting

operation if, upon selection of a fixable distance, a preselectable interval of time or a limit value for a preselectable duration of a slow shifting operation is already exceeded in the course of a shifting movement but
5 the limit for the preselectable distance is not exceeded. Furthermore, the next step can involve an actuation of the torque transmitting system in accordance with the prerequisites for a slow gear shifting operation, for example, a slow disengagement of the torque transmitting
10 system.

For example, the normal speed of opening the actor can be in the range of between 1 to 5000 Nm per second. During that stage of operation of the vehicle when the vehicle is
15 creeping, such creeping being effected as a result of transmission of a small torque, for example, 10 - 20 Nm, it might be advisable to disengage the clutch slowly in the event of an intention to shift. If the clutch is disengaged at a speed of 30 Nm per second, and if the
20 transmissible creeping torque is in the range of 15 Nm, the clutch can be readily disengaged within an interval of one-half of one second. The speed of disengagement of the torque transmitting system can be calculated or determined in dependency upon the operating condition and can be
25 selected differently in dependency upon the driving conditions and the shifting situation.

The full range of velocities of the actor for the torque transmitting system is available for the selection of the
30 speed of disengagement.

As described hereinabove, the shifting intention signal is a digital signal which means that there exists an intention to shift, or it is classified as non-existent,
35 or it does not exist. Furthermore, it is possible to determine or calculate and process the shifting intention

signal as a continuous signal. The clutch torque can be reduced even prior to exceeding of a release threshold or of a preselectable limit value for the initiation of an intention to shift. The transition from "slow
5 disengagement" of the torque transmitting system to "rapid interruption" of the torque transmitting system would then constitute a continuous transition, depending on the nature of actuation of the actuating element by the driver. A continuous transition would also exist for the
10 duration of actual disengagement in the event of a gear shifting operation. Under such operating circumstances, there can develop a short-lasting phase of slip prior to disengagement of the torque transmitting system while the power train is not under stress so that one can in this
15 manner counteract the build-up of a vibration at the input side of the transmission. This means that an at least slight disengagement of the torque transmitting system is already initiated in response to detected movement of the actuating element even though the preselectable threshold
20 value for the recognition of an intention to shift has not been exceeded as yet. The extent of such at least slight disengagement can be selected in dependency upon the filtered or processed signal values but the typical vibrations of the shifting lever should not be considered.

25

The invention seeks to provide a vehicle which comprises an automated torque transmitting system and renders it possible to reliably and effectively shift into various transmission gears basically under all relevant
30 operational circumstances.

Furthermore, the invention seeks to provide a motor vehicle of the above outlined character which is designed in such a way that, even in the event of the development
35 of problems or defects in the region of the gas pedal

system, it is still possible to shift from or into a desired transmission gear.

5 The invention is not limited to that embodiment or those
embodiments which is or are disclosed in the description.
On the contrary it is possible to arrive, within the scope
of the claims, at numerous alterations and modifications,
especially such modifications, elements and combinations
and/or materials which are outlined in the general
10 description and embodiments which can be derived through
combination of the features described here.

Claims

1. Motor vehicle with a driving unit, a transmission and
an automated torque transmitting system, the transmission
5 ratio being selectable by means of an actuating element
and a sensor arrangement detecting the actuation of the
actuating element within a gear shifting gate of a
transmission, characterised in that the gear shifting gate
is divided into at least two regions in which different
10 limit values are utilised for detection of a shifting
intention.

2. Motor vehicle with a driving unit, a transmission and
an automated torque transmitting system, the transmission
15 ratio being selectable by means of an actuating element
and a sensor arrangement detecting the actuation of the
actuating element within a gear shifting gate of a
transmission, characterised in that limit values which are
utilised for the determination of a shifting intention are
20 varied as a function of time.

3. Motor vehicle with a driving unit, a transmission and
an automated torque transmitting system, the transmission
ratio being selectable by means of an actuating element
25 and a sensor arrangement detecting the actuation of the
actuating element within the gear shifting gate of a
transmission, characterised in that limit values which are
utilised for the determination of a shifting intention are
altered, such as raised or lowered, upon reaching or
30 exceeding of limit values.

4. Motor vehicle as claimed in any preceding claim,
wherein a control unit is adapted to generate a control
signal in response to which the torque transmitting system
35 is disengaged upon actuation of the actuating element,
characterised in that the control signal is generated when

a brake is actuated simultaneously with the actuating element.

5. Motor vehicle according to Claim 4, characterised in
5 that the brake is a vehicle brake or a parking brake.

6. Motor vehicle according to Claim 4 or 5,
characterised in that a control signal is generated when a
load lever, a vehicle brake or a parking brake are
10 actuated simultaneously.

7. Motor vehicle as claimed in any preceding claim,
wherein a control unit is adapted to generate a control
signal in response to which the torque transmitting system
15 is disengaged upon actuation of the actuating element,
characterised in that the control signal is generated
when, in response to actuation of the actuating element, a
vehicle speed of the motor vehicle is less than a
preselectable limit value.

20

8. Motor vehicle according to Claim 7, characterised in
that the preselectable limit value for the motor vehicle
speed is in the range of 0 to 50 km/h, preferably of 0 to
30 km/h, and especially of 0 to 10 km/h.

25

9. Motor vehicle as claimed in any preceding claim,
wherein a control unit is adapted to generate a control
signal in response to which the torque transmitting system
is disengaged in response to actuation of the actuating
30 element, characterised in that the control signal is
generated and the torque transmitting system is disengaged
in response to actuation of the actuating element and in
response to fulfilment of at least one of the following
prerequisites:

35

- an idling switch is actuated,

- displacement of a load lever controlling the driving unit is smaller than a preselectable limit value,
- a throttle valve angle of the vehicle driving unit is smaller than a preselectable limit value.
- 5 - a vehicle brake is actuated,
- a vehicle parking brake is actuated,
- a sensor indicates that a vehicle door is open,
- the speed of the motor vehicle is less than a preselectable limit value,
- 10 - the torque of the driving unit is smaller than a preselectable limit value,
- the RPM of the driving unit is smaller than a preselectable limit value,
- the value of the gradient of the driving unit torque
- 15 in the event of a negative gradient exceeds a preselectable limit value,
- the value of the gradient of the driving unit RPM in the event of a negative gradient exceeds a preselectable limit value,
- 20 - the value of the gradient of the vehicle speed in the event of a negative gradient exceeds a preselectable limit value.

10. Motor vehicle as claimed in any preceding claim,
25 wherein a control unit is adapted to generate a control signal in response to which the torque transmitting system is disengaged in response to actuation of the actuating element, characterised in that the control signal is generated and the torque transmitting system is disengaged
30 in response to actuation of the actuating element and after elapse of a waiting time A_t , provided that the actuating element continues to be actuated after elapse of such waiting time and in response to fulfilment of at least one of the following prerequisites:

35

- an idling switch is actuated,

- displacement of a load lever controlling the driving unit is smaller than a preselectable limit value,
 - a throttle valve angle of the vehicle driving unit is smaller than a preselectable limit value.
 - 5 - a vehicle brake is actuated,
 - a vehicle parking brake is actuated,
 - a sensor indicates that a vehicle door is open,
 - the speed of the motor vehicle is less than a preselectable limit value,
 - 10 - the torque of the driving unit is smaller than a preselectable limit value,
 - the RPM of the driving unit is smaller than a preselectable limit value,
 - the value of the gradient of the driving unit torque in the event of a negative gradient exceeds a preselectable limit value,
 - 15 - the value of the gradient of the driving unit RPM in the event of a negative gradient exceeds a preselectable limit value,
 - 20 - the value of the gradient of the vehicle speed in the event of a negative gradient exceeds a preselectable limit value.
11. Motor vehicle according to one of the Claims 7, 9 or
25 10, characterised in that a control signal is generated in response to additional actuation of a load lever, such as a gas pedal.



Application No: GB 0006352.9
Claims searched: 1 to 11

Examiner: Mike McKinney
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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Int CI (Ed.7): F16D 48/06T.

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Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
E; X	GB 2330183 A (LUK)=WO 96/20363 cited in ISR dated 5 September 1997.	1 to 3.
X	GB 2291941 A (FICHTEL & SACHS) see whole document.	1 to 3.
X	GB 2058963 A (DAIHATSU) cited in ISR dated 5 September 1997.	1.
X	WO 89/00517 A1 (AUTOMOTIVE PRODUCTS) cited in ISR dated 5 September 1997.	1.
X	US 5377797 (MUSTAPHA et al) cited in ISR dated 5 September 1997.	1.
X	US 4267907 (HIRAIWA) =DE 2645145 cited in ISR dated 5 September 1997.	1.

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